DOCUMENT RESUME

ED 344 753 SE 052 674

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TITLE Improving Attitudes and Practices in Teaching/Learning by Means of Aerospace In-Service Teacher Education. Aerospace Teacher Education Statistical Study.
PUB DATE 89
NOTE 33p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Aerospace Education; Age Differences; Fieldtrips; Higher Education; *Inservice Teacher Education; Interviews; Questionnaires; Science Education; *Science Instruction; Sex Differences; *Teacher Attitudes; Teacher Qualifications; Teaching Experience; Workshops

ABSTRACT

The purpose of this investigation was to examine the relationship of the first two aerospace education workshops conducted by the United States Space Foundation and sponsored by the Univesity of Colorado, Colorado Springs, and the United States Air Force Academy to attitudes and practices of workshop participants regarding aerospace education. To solve the problem and achieve the purpose of the study, all workshop participants (n=71) were assessed by means of two instruments: (1) an interview questionnaire designed to investigate certain practices employed by educators regarding the teaching of aerospace concepts; and (2) an opinionnaire designed to investigate the attitudes of educators toward aerospace education. It was found that participation in the aerospace education workshops was significantly related to attitudes and practices regarding the teaching of aerospace concepts. It was also found that there was no significant relationship between attitudes toward aerospace education and sex, age, teaching experience, educational preparation, teaching level, and size of the community. Participants felt overwhelmingly that field trips to aerospace industries and installations are important in providing proper educational experiences. (70 references) (KR)

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IMPROVING ATTITUDES AND PRACTICES IN TEACHING\LEARNING BY MEANS OF AEROSPACE IN-SERVICE TEACHER EDUCATION

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AEROSPACE TEACHER EDUCATION
Statistical Study

by J. Christian Romero, Ed.D.

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IMPROVING ATTITUDES AND PRACTICES IN TEACHING\LEARNING BY MEANS OF AEROSPACE IN-SERVICE TEACHER EDUCATION

INTRODUCTION

It has long been recognized that educators contribute to student attitudes about themselves in relation to learning. In recent years efforts have been devoted to the development and improvement of student attitudes toward learning, especially in the areas science and mathematics at the elementary and secondary levels.

Teachers, counselors and other who communicate the genuine expectation of high achievement and success to their students can have strong positive effects on the students' attitudes, academic self-concepts and performance. This expectation cannot be merely verbal, but must be backed up with supportive, positive practices on the part of educator.

Proponents of aerospace education point out advantages of teaching traditional subject areas such as science, mathematics, language arts, and social studies through a transdisciplinary approach utilizing space and aviation concepts, yet educators have been reluctant to totally embrace this strategy. One of the major reasons for this reluctance seems to be the lack of opportunities available for educators to professionally update their skill in the areas aerospace education.

Therefore, this investigation is being conducted in the spirit of contributing to a body of research much needed for creating new

climates of learning which reflect the needs of this age. Aerospace education (Johnson, 1968) in the classroom is imperative if students are to have a meaningful understanding of the contemporary world.

PURPOSE

The purpose of this investigation is to examine the relationship of the first two aerospace education workshops conducted by the United States Space Foundation and sponsored by the University of Colorado, Colorado Springs and the United States Air Force Academy to attitudes and practices of workshop participants regarding aerospace education.

DEFINITION OF TERMS

1. Attitudes toward aerospace education: Attitudes toward aerospace education refers to how an individual feels about aerospace education--an emotionalized feeling for or against aerospace as exhibited by the total score on the summated rating scaled opinionnaire used in this study.
2. Positive attitudes:
   Positive attitudes refer to a score of 105 or greater in the summated rating scale of the opinionnaire used in this study.
3. Practices regarding aerospace education: Practices

regarding aerospace education refers to teacher practices which deal with aerospace education in or out of the classroom, as well as the amount of time spent teaching aerospace education concepts.

4. Aerospace Education:

"Aerospace education (NASA 1987) is a general term referring to a variety of educational topics including aviation, space flight, astronomy, remote sensing, orbital dynamics, communications, and rocketry as well as a number of branches within the disciplines of physics, biology, and chemistry."

5. Workshops:

Regular credit courses sponsored by a college or university during the summer session. They are designed to provide an adequate aerospace education background so that participants will be able to conduct aerospace activities in the classroom.

6. Participant:

Educators who participated in at least one of the two United States Aerospace Education Workshops.

7. Nonparticipants:

Educators who were invited but did not participate in the first two United States Space Foundation Aerospace Education Workshops.

8. Invitees:

All educators (participants and nonparticipants) who were

invited for participation in the first two United States Space Foundation Aerospace Education Workshops.

METHOD

To solve the problem and achieve the purpose of the study, all seventy one workshop participants were assessed by means of two instruments (Romero, 1973): 1) an interview questionnaire designed to investigate certain practices employed by educators regarding the teaching of aerospace concepts; and 2) an opinionnaire designed to investigate the attitudes of educators toward aerospace education. These two instruments were also used to assess a random sample of 71 educators from a total of 531 who were invited, but did not participate. The latter sample was used primarily to obtain comparative data.

The criteria used for selection of the workshop participants and nonparticipants groups are as follows: 1) representation from throughout the U.S.A. that responded to the invitation by the United States Space Foundation (Educators from fourteen states and the District of Columbia responded); 2) representation of K-12 levels; and 3) representation of elementary/secondary education curriculum areas.

Due to a large number of subjects surveyed, the mail questionnaire survey technique was used for the collection of data. The pre-stamped opinionnaire and interview questionnaire along with a cover letter were mailed to all participants and to

the randomly selected sample of nonparticipants.

The return data were tallied on each opinionnaire and interview questionnaire and scores calculated by a DEC VAX 8600 Computer at the University of Colorado, Colorado Springs. The return data consisted of 45% for the participant group and 17% for the nonparticipant group.

Four percent of the opinionnaires and interview questionnaires sent to the nonparticipant group were returned with postal stamp indicating inability to locate the recipient.

The total score of the opinionnaires was used for testing Hypothesis One. Data to test Hypothesis Two were derived from scores of the first 21 items in the interview questionnaire.

The demographic data which consists of questions four through ten on the interview questionnaire were used for evaluating Hypothesis Three. Research questions One and Two were evaluated by the use of items from the opinionnaire as follow: Items 2, 10, 13, and 16 were used to evaluate research Question One; Item 3 was used to evaluate Research Question Two.

In the analysis of the data, chi-square (X^2) and percentage distribution techniques were used. Where the chi-square test showed that there was most likely a relationship between variables, the contingency coefficient (C) was computed to give an indication of the degree of relationship.

The chi-square test was applied to the data obtained from responses to each interview questionnaire item and to the total score on the questionnaire (summated rating scale)

was analyzed according to an agreement continuum of five categories representing intervals of scores as follows: Strongly Agree (154-130); Agree (129-105); Neutral (104-80); Disagree (79-55); and Strongly Disagree (54-34).

The hypotheses were tested for divergence between observed frequencies and those expected. Percentage distribution of the data were used in analyzing Research Questions One and Two.

DATA ANALYSIS

The results of the statistical analyses of the hypotheses tested are stated in the null form as follows:

Hypothesis One: Participation in the first two aerospace education workshops is not significantly related to positive attitudes toward aerospace education.

Hypothesis Two: Participation in the first two aerospace education workshops is not significantly related to the following practices regarding the teaching of aerospace concepts:

1. Use of field trips
2. Use of films
3. Use of aerospace educations materials
4. Use of resource persons
5. Building model airplanes
6. Flying model airplanes
7. Building model rockets

8. Launching model rockets

9. Paper airplane contests

Hypothesis Three: There is no significant relationship between attitudes toward aerospace education and the following demographic data:

1. Teaching level of the workshop invitee
2. Sex of the workshop invitee
3. Age of the workshop invitee
4. Teaching experience of the workshop invitee
5. Educational preparation of the workshop invitee
6. Subject-matter teaching area of the workshop invitee
7. Size of the community where the workshop invitees teaches

In addition to seeking answers to test the hypotheses, answers to the following questions were sought:

1. Do workshop participants feel that aerospace education workshops are necessary in providing proper educational experiences?
2. Do workshop participants feel that trips to aerospace industries and installations are important in providing proper educational experiences?

Hypothesis One

Shown in Table I is the relationship of workshop participation to attitudes toward aerospace education.

TABLE I

CHI-SQUARE VALUES REFLECTING RELATIONSHIP OF WORKSHOP PARTICIPATION TO ATTITUDES TOWARD AEROSPACE EDUCATION

Attitudes	Non-Participants Number	%	Participants Number	%	X^2	DF	Level of Sig.	C
Positive	6	50	28	87.5				
Neutral	6	50	4	12.5	7.0	1	<0.008	0.370
Negative	0	0	0	0				

As indicated in Table I, twenty eight participants (87.5%) recorded positive attitudes as compared to only 50% of the non-participant group. A Chi-square test showed attitude differences between the participants and non-participants groups to be significantly greater than could be due to chance alone (using 0.8 percent chance of error), therefore calling for the rejection of the null hypothesis.

Hypothesis Two

The relationship of workshop participation to practices regarding aerospace education is presented in Tables II and III. Shown in Table II is the relationship of workshop participation to teaching aerospace concepts.

TABLE II

CHI-SQUARE VALUES REFLECTING RELATIONSHIP OF WORKSHOP PARTICIPATION TO TEACHING OF AEROSPACE CONCEPTS

	Non-Participants Number	%	Participants Number	%	X^2	DF	Level of Sig.	C
No	6	50	4	13				
Yes	4	33	26	81	9.4	2	<0.009	0.419
Non-Response	2	17	2	6				

As indicated in Table II, the results of the chi-square (X^2) test showed a significant relationship of workshop participation to teaching aerospace concepts. The Computed X^2 value calls for the rejection of the null hypothesis at a level of significance ($P<0.009$).

While Table II showed the relationship of workshop participation to teaching aerospace concepts, Table III shows the relationship of workshop participation to certain practices regarding the teaching of aerospace concepts.

As indicated in Table III, the results of the chi-square show a significant relationship of workshop participation to all

aerospace activities listed except in the case of utilizing resource persons. The obtained chi-square value called for the rejection of the null hypothesis at the level of significance indicated, except the null hypothesis regarding the use of resource persons, in which case the null hypothesis must be accepted.

TABLE III

CHI-SQUARE VALUES REFLECTING RELATIONSHIP OF WORKSHOP PARTICIPATION TO ENGAGEMENT IN AEROSPACE EDUCATION ACTIVITIES

Aerospace Education Activities	Yes		NR		No					
	P	NP	P	NP	P	NP	X^2	DF	Sig.	C
Field Trips [n]	19	1	6	7	7	4	10.1	2	<0.005	0.432
Multimedia	26	5	5	7	1	0	8.2	2	<0.017	0.395
Resource Person	19	3	7	7	2	6	5.7	2	N.S.	--
Resource Mtls.	22	5	5	7	0	5	8.8	2	<0.013	0.407
Model Airplanes										
Building	12	2	6	9	14	0	13.8	2	<0.001	0.488
Flying	14	2	7	10	11	0	14.4	2	<0.001	0.497
Model Rockets										
Building	14	2	8	10	11	0	12.9	2	<0.002	0.476
Launching	14	2	9	10	11	0	11.5	2	<0.003	0.455

[n] Data recorded as frequency
P-participants
NR-no response
NP-nonparticipants

Hypothesis Three

The relationship between attitudes towards aerospace education and the following demographic data are in Tables IV through X: teaching level of the workshop invitee; sex of the workshop

invitee; age of the workshop invitee; teaching experience of the workshop invitee; educational preparation of the workshop invitee; subject matter area of the workshop invitee; and the size of the community where the workshop invitee taught.

TABLE IV

CHI-SQUARE VALUES REFLECTING RELATIONSHIP BETWEEN TEACHING LEVELS AND ATTITUDES TOWARD AEROSPACE EDUCATION

Teaching Level	Non-Participant Number	%	Participant Number	%	X^2	DF	Level of Sig.	C
K-3	1	8	10	32				
4-6	3	25	15	47				
7-9	4	33	3	9				
					12.1	5	N.S.	--
10-12	2	17	3	9				
Other	0	0	1	3				
Non-response	2	17	0	0				

Shown on Table IV is the relationship between the teaching level of the workshop invitees and their attitudes toward aerospace education.

As revealed in Table IV, the results of the chi-square test show a non-significant relationship between teaching levels and attitudes toward aerospace education. The obtained chi-square of

12.1 called for accepting the null hypothesis.

Shown on Table V is the relationship between sex of workshop invitee and their attitudes toward aerospace education.

TABLE V

CHI-SQUARE VALUES REFLECTING RELATIONSHIP BETWEEN THE SEX OF THE WORKSHOP INVITEE AND ATTITUDES TOWARD AEROSPACE EDUCATION

Sex	Non-Participant Number	%	Participant Number	%	X^2	DF	Level of Sig.	C
Female	5	42	23	72				
Male	5	42	5	16				
					6.4	2	N.S.	--
Non-Response	2	16	4	12				

As indicated in Table V, the results of the chi-square test show a nonsignificant relationship between sex and attitudes toward aerospace education. The obtained chi-square value of 6.4 call for the acceptance of the null hypothesis.

Shown in Table VI is the relationship between the age of the workshop invitees and their attitudes toward aerospace education.

TABLE VI

CHI-SQUARE VALUES REFLECTING RELATIONSHIP BETWEEN AGE OF WORKSHOP INVITEE AND ATTITUDES TOWARD AEROSPACE EDUCATION

Age	Non-Participant Number	%	Participant Number	%	X^2	DF	Level of Sig.	C
50-59	4	33	4	13				
40-49	2	17	10	31				
30-39	4	33	13	41				
					5.8	5	N.S.	--
26-29	1	8	3	9				
Under 25	0	0	1	3				
Non-Response	1	8	1	3				

As indicated in Table VI, the results of the chi-square test show a nonsignificant relationship between age attitudes toward aerospace education. The obtained chi-square value of 5.8 called for the acceptance of the null hypothesis.

Shown in Table VII is the relationship between the number of years that the workshop invitee has taught and their attitudes toward aerospace education.

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The results of the chi-square test shown in Table VII indicate that there is no significant relationship between the number of years of teaching experience and attitudes toward aerospace education. The obtained chi-square value of 5.5 called for accepting the null hypothesis.

TABLE VII

CHI-SQUARE VALUES REFLECTING RELATIONSHIP BETWEEN NUMBER OF YEARS TEACHING EXPERIENCE AND ATTITUDES TOWARD AEROSPACE EDUCATION

Years Teaching Experience	Non-Participant Number	%	Participant Number	%	X^2	DF	Level of Sig.	C
19 or more	3	25	6	19				
16-18	1	8	3	9				
13-15	1	8	4	13				
					5.5	7	N.S.	--
10-12	3	25	6	19				
7-9	0	0	6	19				
4-6	2	17	4	13				
1-3	1	8	3	9				
Non-Response	1	8	0	0				

Shown in Table VIII is the relationship between attitudes toward aerospace education and degree held. The results of chi-square test show a nonsignificant relationship between educational preparation and attitudes toward aerospace education. The obtained chi-square value of 9.7 resulted in the acceptance of the null hypothesis.

TABLE VIII

CHI-SQUARE VALUES REFLECTING RELATIONSHIPS BETWEEN EDUCATIONAL PREPARATION AND ATTITUDES TOWARD AEROSPACE EDUCATION

Degrees	Non-Participant Number	%	Participant Number	%	X^2	DF	Level of Sig.	C
Associate	0	0	1	3				
Bachelor	3	25	16	50				
					9.7	4	N.S.	- -
					9.7	4	N.S.	--
Master`s	6	50	15	47				
Doctorate	1	8	0	0				
Non-Response	2	17	0	0				

Shown in table IX is the relationship between the subject matter area which the workshop invitees have taught and their attitudes toward aerospace education.

TABLE IX

CHI-SQUARE VALUES REFLECTING RELATIONSHIP BETWEEN SUBJECT MATTER TEACHING AREA AND ATTITUDE TOWARD AEROSPACE EDUCATION

Subject Matter	Non-Participant Number	%	Participant Number	%	X^2	DF	Level of Sig.	C
Science	3	25	12	38				
Mathematics	1	8	4	13				
Language Arts	2	17	6	19				
					3.1	6	N.S.	--
Social Science	1	8	3	9				
Humanities	1	8	2	6				
Others	2	17	4	13				
Non-Response	2	17	1	3				

The results of the chi-square test shown in Table IX indicate that there is no significant relationship between subject matter area taught and attitudes toward aerospace education. The obtained chi-square value of 3.1 called for the acceptance of the null hypothesis.

Shown in Table X is the relationship between the size of the community where the workshop invitees taught and their attitudes toward aerospace education.

TABLE X

CHI-SQUARE REFLECTING RELATIONSHIP BETWEEN THE SIZE OF THE COMMUNITY WHERE THE WORKSHOP INVITEES TEACH AND ATTITUDE TOWARD AEROSPACE EDUCATION

Size of Community	Non-Participant Number	%	Participant Number	%	X^2	DF	Level of Sig.	C
Metropolitan	2	17	0	0				
Suburban	2	17	21	66				
Population 25000-100000	2	17	5	16				
					17.5	5	N.S.	--
Population 5000-9999	0	0	2	6				
Population < 5000	4	33	4	12				
Non-Response	2	17	0	0				

The results of the chi-square test shown in Table X reveals that there is no significant relationship between the size of the community where the workshop invitee teaches and attitudes toward aerospace education. The obtained chi-square test of 17.5 called

for the acceptance of the null hypothesis.

Research Question Number One

Do workshop invitees feel that aerospace education workshops are necessary in providing proper educational experiences?

To obtain an answer to Research Question Number One, items 2, 10, 13, and 16 of the opinionnaire were analyzed. Table XI shows the responses of these four items.

TABLE XI

RESPONSES OF WORKSHOP INVITEES TO OPINIONNAIRE ITEMS 2, 10, 13, AND 16

Item Number	SA	A	N	D	SD
2	[n] 25.0	52.3	6.8	13.6	2.3
10	40.9	34.1	22.7	2.3	0.0
13	43.2	52.3	2.3	2.3	0.0
16	2.3	6.8	4.3	25.0	61.4

[n] Data reported as frequency

Items 2, 10, and 13 shown in Table XI indicate a high degree of consistency that the responses are in agreement with these statements, which are stated in a positive format. On the other hand, the responses to item 16, which is stated negatively, shows a strong disagreement with the statement. An analysis of this data

signifies that workshop invitees feel that aerospace education workshops are necessary in providing proper educational experiences.

Research Question Number Two

Do workshop invitees feel that trips to aerospace industries and installations are important in providing proper educational experiences?

To obtain an answer to Research Question Number Two, the data of items 3 and 30 of the opinionnaire were analyzed. The responses of the workshop invitees to these items are shown in Table XII.

TABLE XII

RESPONSES OF WORKSHOP INVITEES TO OPINIONNAIRE ITEMS 3 AND 30

Item Number	SA	A	N	D	SD
3	50.0 [n]	50.0	0.0	0.0	0.0
30	50.0	45.5	4.5	0.0	0.0

[n] Data reported in percentages

As indicated in Table XII, the two opinionnaire items surveyed show most of the responses in the "strongly agree" and agree columns. An examination of the percentages indicates that the

workshop invitees feel that aerospace education workshops should continue providing educational experiences, such as field trips to aerospace industries and installations.

DISCUSSION

Summary

The problem of this study was the relationship of aerospace education workshops to attitudes and certain practices of workshop participants concerning aerospace education.

To solve the problem and achieve the purpose of the study, all seventy one workshop participants were assessed by means of two instruments: 1) an interview questionnaire designed to investigate certain practices employed by educators regarding the teaching of aerospace concepts; and 2) an opinionnaire designed to investigate the attitudes of teachers toward aerospace education. These two instruments were also used to assess a random sample of seventy one educators from a total of 461 who were invited but did not participate in the first two aerospace education workshops conducted by the United States Space Foundation.

The findings of this study are summarized as follows:

1. Hypothesis One was rejected. Hypothesis One dealt with the relationship of workshop participation to attitudes toward aerospace education. The chi-square test indicates that workshop participation is significantly related to attitudes toward

aerospace education. The computed chi-square value of 7.0 at a level of significance, ($P<0.008$) called for the rejection of the null hypothesis (Table I).

2. Null Hypothesis Two was partially rejected. Hypothesis Two dealt with the relationship of workshop participation to certain practices regarding aerospace education. Findings, as indicated by the chi-square test are as follows:

a. Participation in the workshops is significantly related to teaching aerospace concepts: the chi-square value of 9.4 at a level of significance, ($P<0.009$) called for the rejection of the null hypothesis.

b. Participation in the workshop is significantly related to conducting the following activities by teachers with their students, except the utilization of a resource person in which case the null hypothesis was accepted:

1) Field Trips to aerospace industries and installations: The chi-square value of 10.1 at a level of significance, ($P<0.005$) called for the rejection of the null hypothesis.

2) Viewing films dealing with aerospace: The chi-square value of 8.2 at a level of significance, ($P<0.017$) called for the rejection of the null hypothesis.

3) Utilization of aerospace resource personnel: The chi-square value of 5.7 called for the acceptance of the null hypothesis.

4) Utilization of aerospace resource materials: The chi-square value of 8.8 at a level of significance, ($P<0.013$) called

for the rejection of the null hypothesis.

5) Building of model airplanes: The chi-square value 13.8 at a level of significance (P<0.001) called for the rejection of the null hypothesis.

6) Flying model airplanes: The chi-square value of 14.4 at a level of significance (P<0.001) called for the rejection of the null hypothesis.

7) Building model rockets: The chi-square value of 12.9 at a level of significance, (P<0.002) called for the rejection of the null hypothesis.

8) Launching model rockets: The chi-square value of 11.5 at a level of significance (P<0.003) called for the rejection of the null hypothesis.

9) Paper airplane contests: The chi-square value of 6.2 at a level of significance (P<0.045) called for the rejection of the null hypothesis.

3. Null hypothesis Three was accepted. There is no significant relationship between attitudes toward aerospace education and the following demographic data as it relates to the workshop invitees: sex, age, teaching experience, educational preparation, teaching level, subject matter area and size of the community where the invitee taught. Findings, as indicated by the chi-square test are as follows:

a. There is no significant relationship between teaching level and attitudes toward aerospace education: The chi-square value of 12.1 at a level of significance, (P>0.033) called for the

acceptance of the null hypothesis.

b. There is no significant relationship between sex of the workshop invitees and their attitudes toward aerospace education. The chi-square value of 6.4 at a level of significance, (P>0.041) called for the acceptance of the null hypothesis.

c. There is no significant relationship between the age of the workshop invitees ant their attitudes toward aerospace education: The chi-square value of 5.8 at a level of significance, (P>0.32) called for the acceptance of the null hypothesis.

d. There is no significant relationship between the number of years teaching experience and attitudes towards aerospace education. The chi-square value of 5.5 at a level of significance, (P>0.597) called for acceptance of the null hypothesis.

e. There is no significant relationship between the educational preparation of the workshop invitees to their attitudes toward aerospace education. The chi-square value of 9.66 at a level of significance, (P>0.047) call for acceptance of the null hypothesis.

f. There is no significant relationship between the subject matter teaching area and attitudes toward aerospace education. The chi-square value of 3.1 at a level of significance, (P>0.799) called for acceptance of the null hypothesis.

g. There is no significant relationship between the size of the community where the workshop invitee taught and their attitudes toward aerospace education. The chi-square value of 17.5 at a level of significance, (P>0.004) called for acceptance of the

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null hypothesis.

Conclusions

Based on the findings of this study, the following conclusions may be made:

1. Participation in the first two United States Space Foundation aerospace education workshops is significantly related to attitudes toward aerospace education. This conclusion indicates that a well-structured and properly conducted workshop can have a positive effect on the attitudes of participating educators.

2. Participation in the first two United States Space Foundation is significantly related to practices regarding the teaching of aerospace concepts. The workshop activities evaluated by this study indicate a significant relationship of workshop participation to employing these activities by educators in teaching situations. The results of the study showed only one activity (use of aerospace education resource personnel), as having an insignificant relationship, which may be due to the lack of resource personnel in the areas of aerospace education.

3. The test of Hypothesis Three shows that there is no significant relationship between attitudes toward aerospace education and the following demographic data: sex, age, teaching experience, educational preparation, teaching level, and size of the community. Since the demographic data might have been an influencing factor in the evaluation of attitudes towards aerospace education, the results of non-significance strengthened

the basis for conclusion that participation in the first two aerospace education workshops is significantly related to positive attitudes toward aerospace education.

4. An analysis of items 2, 10, 13 and 16 of the opinionnaire indicate that the workshop invitees feel that aerospace education should be a vital part of the total educational plan.

5. An analysis of item 3 of the opinionnaire indicated the workshop invitees overwhelmingly feel that field trips to aerospace industries and installations are important in providing proper educational experiences.

While this study has established a relationship of in-service aerospace education to practices and attitudes of participating educators during the first two workshops conducted by the United States Space Foundation, it is hoped that follow-up studies of this type continue to be conducted so that the base of aerospace education may be broadened and further validate it as an effective teaching tool through which students acquire valuable skills, knowledge and attitudes.

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